

SEQUENCE LISTING

<110> BASF Aktiengesellschaft

<120> Process for the biotransformation of carotenoids

<130> M43191 beta-Karotin Biotransformation

<140>

<141>

<160> 12

<170> PatentIn Ver. 2.1

<210> 1

<211> 1170

<212> DNA

<213> Thermus thermophilus

<220>

<221> CDS

<222> (1)..(1170)

<400> 1

| | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|
| atg | aag | cgc | ctt | tcc | ctg | agg | gag | gcc | tgg | ccc | tac | ctg | aaa | gac | ctc | 48 |
| Met | Lys | Arg | Leu | Ser | Leu | Arg | Glu | Ala | Trp | Pro | Tyr | Leu | Lys | Asp | Leu | |
| 1 | | | | 5 | | | | | 10 | | | | | 15 | | |

| | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|
| cag | caa | gat | ccc | ctc | gcc | gtc | ctg | ctg | gcg | tgg | ggc | cgg | gcc | cac | ccc | 96 |
| Gln | Gln | Asp | Pro | Leu | Ala | Val | Leu | Leu | Ala | Trp | Gly | Arg | Ala | His | Pro | |
| | | | 20 | | | | 25 | | | | | | 30 | | | |

| | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| cgg | ctc | ttc | ctt | ccc | ctg | ccc | cgc | ttc | ccc | ctg | gcc | ctg | atc | ttt | gac | 144 |
| Arg | Leu | Phe | Leu | Pro | Leu | Pro | Arg | Phe | Pro | Leu | Ala | Leu | Ile | Phe | Asp | |
| | | 35 | | | | | 40 | | | | | 45 | | | | |

| | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| ccc | gag | ggg | gtg | gag | ggg | gcg | ctc | ctc | gcc | gag | ggg | acc | acc | aag | gcc | 192 |
| Pro | Glu | Gly | Val | Glu | Gly | Ala | Leu | Leu | Ala | Glu | Gly | Thr | Thr | Lys | Ala | |
| | 50 | | | | | 55 | | | | 60 | | | | | | |

| | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| acc | ttc | cag | tac | cgg | gcc | ctc | tcc | cgc | ctc | acg | ggg | agg | ggc | ctc | ctc | 240 |
| Thr | Phe | Gln | Tyr | Arg | Ala | Leu | Ser | Arg | Leu | Thr | Gly | Arg | Gly | Leu | Leu | |
| 65 | | | | | 70 | | | | 75 | | | | | 80 | | |

| | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| acc | gac | tgg | ggg | gaa | agc | tgg | aag | gag | gcg | cgc | aag | gcc | ctc | aaa | gac | 288 |
| Thr | Asp | Trp | Gly | Glu | Ser | Trp | Lys | Glu | Ala | Arg | Lys | Ala | Leu | Lys | Asp | |
| | | | 85 | | | | | 90 | | | | | | 95 | | |

| | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| ccc | ttc | ctg | ccg | aag | aac | gtc | cgc | ggc | tac | cgg | gag | gcc | atg | gag | gag | 336 |
| Pro | Phe | Leu | Pro | Lys | Asn | Val | Arg | Gly | Tyr | Arg | Glu | Ala | Met | Glu | Glu | |
| | | 100 | | | | | | 105 | | | | | 110 | | | |

| | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| gag | gcc | cgg | gcc | ttc | ttc | ggg | gag | tgg | cgg | ggg | gag | gag | cgg | gac | ctg | 384 |
| Glu | Ala | Arg | Ala | Phe | Phe | Gly | Glu | Trp | Arg | Gly | Glu | Glu | Arg | Asp | Leu | |
| | | 115 | | | | 120 | | | | | 125 | | | | | |

| | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| gac | cac | gag | atg | ctc | gcc | ctc | tcc | ctg | cgc | ctc | ctc | ggg | cgg | gcc | ctc | 432 |
| Asp | His | Glu | Met | Leu | Ala | Leu | Ser | Leu | Arg | Leu | Leu | Gly | Arg | Ala | Leu | |
| | 130 | | | | | 135 | | | | 140 | | | | | | |

| | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| ttc | ggg | aag | ccc | ctc | tcc | cca | agc | ctc | gcg | gag | cac | gcc | ctt | aag | gcc | 480 |
| Phe | Gly | Lys | Pro | Leu | Ser | Pro | Ser | Leu | Ala | Glu | His | Ala | Leu | Lys | Ala | |

| 145 | 150 | 155 | 160 | |
|---|-----|-----|-----|------|
| ctg gac cgg atc atg gcc cag acc agg agc ccc ctg gcc ctc ctg gac | | | | 528 |
| Leu Asp Arg Ile Met Ala Gln Thr Arg Ser Pro Leu Ala Leu Leu Asp | | | | |
| | 165 | 170 | 175 | |
| ctg gcc gcc gaa gcc cgc ttc cgg aag gac cgg ggg gcc ctc tac cgc | | | | 576 |
| Leu Ala Ala Glu Ala Arg Phe Arg Lys Asp Arg Gly Ala Leu Tyr Arg | | | | |
| | 180 | 185 | 190 | |
| gag gcg gaa gcc ctc atc gtc cac ccg ccc ctc tcc cac ctt ccc cga | | | | 624 |
| Glu Ala Glu Ala Leu Ile Val His Pro Pro Leu Ser His Leu Pro Arg | | | | |
| | 195 | 200 | 205 | |
| gag cgc gcc ctg agc gag gcc gtg acc ctc ctg gtg gcg ggc cac gag | | | | 672 |
| Glu Arg Ala Leu Ser Glu Ala Val Thr Leu Leu Val Ala Gly His Glu | | | | |
| | 210 | 215 | 220 | |
| acg gtg gcg agc gcc ctc acc tgg tcc ttt ctc ctc ctc tcc cac cgc | | | | 720 |
| Thr Val Ala Ser Ala Leu Thr Trp Ser Phe Leu Leu Leu Ser His Arg | | | | |
| | 225 | 230 | 235 | 240 |
| ccg gac tgg cag aag cgg gtg gcc gag agc gag gag gcg gcc ctc gcc | | | | 768 |
| Pro Asp Trp Gln Lys Arg Val Ala Glu Ser Glu Glu Ala Ala Leu Ala | | | | |
| | 245 | 250 | 255 | |
| gcc ttc cag gag gcc ctg agg ctc tac ccc ccc gcc tgg atc ctc acc | | | | 816 |
| Ala Phe Gln Glu Ala Leu Arg Leu Tyr Pro Pro Ala Trp Ile Leu Thr | | | | |
| | 260 | 265 | 270 | |
| cgg agg ctg gaa agg ccc ctc ctc ctg gga gag gac cgg ctc ccc ccg | | | | 864 |
| Arg Arg Leu Glu Arg Pro Leu Leu Leu Gly Glu Asp Arg Leu Pro Pro | | | | |
| | 275 | 280 | 285 | |
| ggc acc acc ctg gtc ctc tcc ccc tac gtg acc cag agg ctc cac ttc | | | | 912 |
| Gly Thr Thr Leu Val Leu Ser Pro Tyr Val Thr Gln Arg Leu His Phe | | | | |
| | 290 | 295 | 300 | |
| ccc gat ggg gag gcc ttc cgg ccc gag cgc ttc ctg gag gaa agg ggg | | | | 960 |
| Pro Asp Gly Glu Ala Phe Arg Pro Glu Arg Phe Leu Glu Glu Arg Gly | | | | |
| | 305 | 310 | 315 | 320 |
| acc cct tcg ggg cgc tac ttc ccc ttt ggc ctg ggg cag agg ctc tgc | | | | 1008 |
| Thr Pro Ser Gly Arg Tyr Phe Pro Phe Gly Leu Gly Gln Arg Leu Cys | | | | |
| | 325 | 330 | 335 | |
| ctg ggg cgg gac ttc gcc ctc ctc gag ggc ccc atc gtc ctc agg gcc | | | | 1056 |
| Leu Gly Arg Asp Phe Ala Leu Leu Glu Gly Pro Ile Val Leu Arg Ala | | | | |
| | 340 | 345 | 350 | |
| ttc ttc cgc cgc ttc cgc cta gac ccc ctc ccc ttc ccc cgg gtc ctc | | | | 1104 |
| Phe Phe Arg Arg Phe Arg Leu Asp Pro Leu Pro Phe Pro Arg Val Leu | | | | |
| | 355 | 360 | 365 | |
| gcc cag gtc acc ctg agg ccc gaa ggc ggg ctt ccc gcg cgg cct agg | | | | 1152 |
| Ala Gln Val Thr Leu Arg Pro Glu Gly Gly Leu Pro Ala Arg Pro Arg | | | | |
| | 370 | 375 | 380 | |
| gag gag gtg cgg gcg tga | | | | 1170 |
| Glu Glu Val Arg Ala | | | | |
| | 385 | 390 | | |

<210> 2
 <211> 389
 <212> PRT
 <213> *Thermus thermophilus*

<400> 2
 Met Lys Arg Leu Ser Leu Arg Glu Ala Trp Pro Tyr Leu Lys Asp Leu
 1 5 10 15
 Gln Gln Asp Pro Leu Ala Val Leu Leu Ala Trp Gly Arg Ala His Pro
 20 25 30
 Arg Leu Phe Leu Pro Leu Pro Arg Phe Pro Leu Ala Leu Ile Phe Asp
 35 40 45
 Pro Glu Gly Val Glu Gly Ala Leu Leu Ala Glu Gly Thr Thr Lys Ala
 50 55 60
 Thr Phe Gln Tyr Arg Ala Leu Ser Arg Leu Thr Gly Arg Gly Leu Leu
 65 70 75 80
 Thr Asp Trp Gly Glu Ser Trp Lys Glu Ala Arg Lys Ala Leu Lys Asp
 85 90 95
 Pro Phe Leu Pro Lys Asn Val Arg Gly Tyr Arg Glu Ala Met Glu Glu
 100 105 110
 Glu Ala Arg Ala Phe Phe Gly Glu Trp Arg Gly Glu Glu Arg Asp Leu
 115 120 125
 Asp His Glu Met Leu Ala Leu Ser Leu Arg Leu Leu Gly Arg Ala Leu
 130 135 140
 Phe Gly Lys Pro Leu Ser Pro Ser Leu Ala Glu His Ala Leu Lys Ala
 145 150 155 160
 Leu Asp Arg Ile Met Ala Gln Thr Arg Ser Pro Leu Ala Leu Leu Asp
 165 170 175
 Leu Ala Ala Glu Ala Arg Phe Arg Lys Asp Arg Gly Ala Leu Tyr Arg
 180 185 190
 Glu Ala Glu Ala Leu Ile Val His Pro Pro Leu Ser His Leu Pro Arg
 195 200 205
 Glu Arg Ala Leu Ser Glu Ala Val Thr Leu Leu Val Ala Gly His Glu
 210 215 220
 Thr Val Ala Ser Ala Leu Thr Trp Ser Phe Leu Leu Leu Ser His Arg
 225 230 235 240
 Pro Asp Trp Gln Lys Arg Val Ala Glu Ser Glu Glu Ala Ala Leu Ala
 245 250 255
 Ala Phe Gln Glu Ala Leu Arg Leu Tyr Pro Pro Ala Trp Ile Leu Thr
 260 265 270
 Arg Arg Leu Glu Arg Pro Leu Leu Leu Gly Glu Asp Arg Leu Pro Pro
 275 280 285
 Gly Thr Thr Leu Val Leu Ser Pro Tyr Val Thr Gln Arg Leu His Phe
 290 295 300

Pro Asp Gly Glu Ala Phe Arg Pro Glu Arg Phe Leu Glu Glu Arg Gly
 305 310 315 320
 Thr Pro Ser Gly Arg Tyr Phe Pro Phe Gly Leu Gly Gln Arg Leu Cys
 325 330 335
 Leu Gly Arg Asp Phe Ala Leu Leu Glu Gly Pro Ile Val Leu Arg Ala
 340 345 350
 Phe Phe Arg Arg Phe Arg Leu Asp Pro Leu Pro Phe Pro Arg Val Leu
 355 360 365
 Ala Gln Val Thr Leu Arg Pro Glu Gly Gly Leu Pro Ala Arg Pro Arg
 370 375 380
 Glu Glu Val Arg Ala
 385

<210> 3
 <211> 1188
 <212> DNA
 <213> Artificial sequence

<220>
 <221> misc_feature
 <222> (4)..(21)
 <223> His tag

<220>
 <223> Description of the artificial sequence: N-terminal
 his tagged

<220>
 <221> CDS
 <222> (1)..(1188)

<400> 3
 atg cat cac cat cat cat cac aag cgc ctt tcc ctg agg gag gcc tgg 48
 Met His His His His His His Lys Arg Leu Ser Leu Arg Glu Ala Trp
 1 5 10 15
 ccc tac ctg aaa gac ctc cag caa gat ccc ctc gcc gtc ctg ctg gcg 96
 Pro Tyr Leu Lys Asp Leu Gln Gln Asp Pro Leu Ala Val Leu Leu Ala
 20 25 30
 tgg ggc cgg gcc cac ccc cgg ctc ttc ctt ccc ctg ccc cgc ttc ccc 144
 Trp Gly Arg Ala His Pro Arg Leu Phe Leu Pro Leu Pro Arg Phe Pro
 35 40 45
 ctg gcc ctg atc ttt gac ccc gag ggg gtg gag ggg gcg ctc ctc gcc 192
 Leu Ala Leu Ile Phe Asp Pro Glu Gly Val Glu Gly Ala Leu Leu Ala
 50 55 60
 gag ggg acc acc aag gcc acc ttc cag tac cgg gcc ctc tcc cgc ctc 240
 Glu Gly Thr Thr Lys Ala Thr Phe Gln Tyr Arg Ala Leu Ser Arg Leu
 65 70 75 80
 acg ggg agg ggc ctc ctc acc gac tgg ggg gaa agc tgg aag gag gcg 288
 Thr Gly Arg Gly Leu Leu Thr Asp Trp Gly Glu Ser Trp Lys Glu Ala
 85 90 95

| | |
|---|------|
| cgc aag gcc ctc aaa gac ccc ttc ctg ccg aag aac gtc cgc ggc tac | 336 |
| Arg Lys Ala Leu Lys Asp Pro Phe Leu Pro Lys Asn Val Arg Gly Tyr | |
| 100 105 110 | |
| cgg gag gcc atg gag gag gag gcc cgg gcc ttc ttc ggg gag tgg cgg | 384 |
| Arg Glu Ala Met Glu Glu Glu Ala Arg Ala Phe Phe Gly Glu Trp Arg | |
| 115 120 125 | |
| ggg gag gag cgg gac ctg gac cac gag atg ctc gcc ctc tcc ctg cgc | 432 |
| Gly Glu Glu Arg Asp Leu Asp His Glu Met Leu Ala Leu Ser Leu Arg | |
| 130 135 140 | |
| ctc ctc ggg cgg gcc ctc ttc ggg aag ccc ctc tcc cca agc ctc gcg | 480 |
| Leu Leu Gly Arg Ala Leu Phe Gly Lys Pro Leu Ser Pro Ser Leu Ala | |
| 145 150 155 160 | |
| gag cac gcc ctt aag gcc ctg gac cgg atc atg gcc cag acc agg agc | 528 |
| Glu His Ala Leu Lys Ala Leu Asp Arg Ile Met Ala Gln Thr Arg Ser | |
| 165 170 175 | |
| ccc ctg gcc ctc ctg gac ctg gcc gcc gaa gcc cgc ttc cgg aag gac | 576 |
| Pro Leu Ala Leu Leu Asp Leu Ala Ala Glu Ala Arg Phe Arg Lys Asp | |
| 180 185 190 | |
| cgg ggg gcc ctc tac cgc gag gcg gaa gcc ctc atc gtc cac ccg ccc | 624 |
| Arg Gly Ala Leu Tyr Arg Glu Ala Glu Ala Leu Ile Val His Pro Pro | |
| 195 200 205 | |
| ctc tcc cac ctt ccc cga gag cgc gcc ctg agc gag gcc gtg acc ctc | 672 |
| Leu Ser His Leu Pro Arg Glu Arg Ala Leu Ser Glu Ala Val Thr Leu | |
| 210 215 220 | |
| ctg gtg gcg ggc cac gag acg gtg gcg agc gcc ctc acc tgg tcc ttt | 720 |
| Leu Val Ala Gly His Glu Thr Val Ala Ser Ala Leu Thr Trp Ser Phe | |
| 225 230 235 240 | |
| ctc ctc ctc tcc cac cgc ccg gac tgg cag aag cgg gtg gcc gag agc | 768 |
| Leu Leu Leu Ser His Arg Pro Asp Trp Gln Lys Arg Val Ala Glu Ser | |
| 245 250 255 | |
| gag gag gcg gcc ctc gcc gcc ttc cag gag gcc ctg agg ctc tac ccc | 816 |
| Glu Glu Ala Ala Leu Ala Ala Phe Gln Glu Ala Leu Arg Leu Tyr Pro | |
| 260 265 270 | |
| ccc gcc tgg atc ctc acc cgg agg ctg gaa agg ccc ctc ctc ctg gga | 864 |
| Pro Ala Trp Ile Leu Thr Arg Arg Leu Glu Arg Pro Leu Leu Leu Gly | |
| 275 280 285 | |
| gag gac cgg ctc ccc ccg ggc acc acc ctg gtc ctc tcc ccc tac gtg | 912 |
| Glu Asp Arg Leu Pro Pro Gly Thr Thr Leu Val Leu Ser Pro Tyr Val | |
| 290 295 300 | |
| acc cag agg ctc cac ttc ccc gat ggg gag gcc ttc cgg ccc gag cgc | 960 |
| Thr Gln Arg Leu His Phe Pro Asp Gly Glu Ala Phe Arg Pro Glu Arg | |
| 305 310 315 320 | |
| ttc ctg gag gaa agg ggg acc cct tcg ggg cgc tac ttc ccc ttt ggc | 1008 |
| Phe Leu Glu Glu Arg Gly Thr Pro Ser Gly Arg Tyr Phe Pro Phe Gly | |
| 325 330 335 | |
| ctg ggg cag agg ctc tgc ctg ggg cgg gac ttc gcc ctc ctc gag ggc | 1056 |
| Leu Gly Gln Arg Leu Cys Leu Gly Arg Asp Phe Ala Leu Leu Glu Gly | |
| 340 345 350 | |

ccc atc gtc ctc agg gcc ttc ttc cgc cgc ttc cgc cta gac ccc ctc 1104
Pro Ile Val Leu Arg Ala Phe Phe Arg Arg Phe Arg Leu Asp Pro Leu
355 360 365

| | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| ccc | ttc | ccc | cgg | gtc | ctc | gcc | cag | gtc | acc | ctg | agg | ccc | gaa | ggc | ggg | 1152 |
| Pro | Phe | Pro | Arg | Val | Leu | Ala | Gln | Val | Thr | Leu | Arg | Pro | Glu | Gly | Gly | |
| | 370 | | | | | 375 | | | | | 380 | | | | | |

ctt ccc gcg cgg cct agg gag gag gtg cgg gcg tga 1188
Leu Pro Ala Arg Pro Arg Glu Glu Val Arg Ala
385 390 395

<210> 4

<211> 395

<212> PRT

<213> Artificial sequence

<223> Description of the artificial sequence: N-terminal his tagged

<400> 4

Met His His His His His His Lys Arg Leu Ser Leu Arg Glu Ala Trp
1 5 10 15

Pro Tyr Leu Lys Asp Leu Gln Gln Asp Pro Leu Ala Val Leu Leu Ala
20 25 30

Trp Gly Arg Ala His Pro Arg Leu Phe Leu Pro Leu Pro Arg Phe Pro
35 40 45

Leu Ala Leu Ile Phe Asp Pro Glu Gly Val Glu Gly Ala Leu Leu Ala
50 55 60

Glu Gly Thr Thr Lys Ala Thr Phe Gln Tyr Arg Ala Leu Ser Arg Leu
65 70 75 80

Thr Gly Arg Gly Leu Leu Thr Asp Trp Gly Glu Ser Trp Lys Glu Ala
85 90 95

Arg Lys Ala Leu Lys Asp Pro Phe Leu Pro Lys Asn Val Arg Gly Tyr
100 105 110

Arg Glu Ala Met Glu Glu Glu Ala Arg Ala Phe Phe Gly Glu Trp Arg
115 120 125

Gly Glu Glu Arg Asp Leu Asp His Glu Met Leu Ala Leu Ser Leu Arg
130 135 140

Leu Leu Gly Arg Ala Leu Phe Gly Lys Pro Leu Ser Pro Ser Leu Ala
145 150 155 160

Glu His Ala Leu Lys Ala Leu Asp Arg Ile Met Ala Gln Thr Arg Ser
165 170 175

Pro Leu Ala Leu Leu Asp Leu Ala Ala Glu Ala Arg Phe Arg Lys Asp
180 185 190

Arg Gly Ala Leu Tyr Arg Glu Ala Glu Ala Leu Ile Val His Pro Pro
195 200 205

Leu Ser His Leu Pro Arg Glu Arg Ala Leu Ser Glu Ala Val Thr Leu
210 215 220

Leu Val Ala Gly His Glu Thr Val Ala Ser Ala Leu Thr Trp Ser Phe
 225 230 235 240

Leu Leu Leu Ser His Arg Pro Asp Trp Gln Lys Arg Val Ala Glu Ser
 245 250 255

Glu Glu Ala Ala Leu Ala Ala Phe Gln Glu Ala Leu Arg Leu Tyr Pro
 260 265 270

Pro Ala Trp Ile Leu Thr Arg Arg Leu Glu Arg Pro Leu Leu Leu Gly
 275 280 285

Glu Asp Arg Leu Pro Pro Gly Thr Thr Leu Val Leu Ser Pro Tyr Val
 290 295 300

Thr Gln Arg Leu His Phe Pro Asp Gly Glu Ala Phe Arg Pro Glu Arg
 305 310 315 320

Phe Leu Glu Glu Arg Gly Thr Pro Ser Gly Arg Tyr Phe Pro Phe Gly
 325 330 335

Leu Gly Gln Arg Leu Cys Leu Gly Arg Asp Phe Ala Leu Leu Glu Gly
 340 345 350

Pro Ile Val Leu Arg Ala Phe Phe Arg Arg Phe Arg Leu Asp Pro Leu
 355 360 365

Pro Phe Pro Arg Val Leu Ala Gln Val Thr Leu Arg Pro Glu Gly Gly
 370 375 380

Leu Pro Ala Arg Pro Arg Glu Glu Val Arg Ala
 385 390 395

<210> 5
 <211> 1188
 <212> DNA
 <213> Artificial sequence

<220>
 <221> misc_feature
 <222> (1168)..(1185)
 <223> His tag

<220>
 <223> Description of the artificial sequence: N-terminal
 His-tagged

<220>
 <221> CDS
 <222> (1)..(1188)

<400> 5
 atg aag cgc ctt tcc ctg agg gag gcc tgg ccc tac ctg aaa gac ctc 48
 Met Lys Arg Leu Ser Leu Arg Glu Ala Trp Pro Tyr Leu Lys Asp Leu
 1 5 10 15

cag caa gat ccc ctc gcc gtc ctg ctg gcg tgg ggc cgg gcc cac ccc 96
 Gln Gln Asp Pro Leu Ala Val Leu Leu Ala Trp Gly Arg Ala His Pro
 20 25 30

| | |
|---|-----|
| cgg ctc ttc ctt ccc ctg ccc cgc ttc ccc ctg gcc ctg atc ttt gac | 144 |
| Arg Leu Phe Leu Pro Leu Pro Arg Phe Pro Leu Ala Leu Ile Phe Asp | |
| 35 40 45 | |
| ccc gag ggg gtg gag ggg gcg ctc ctc gcc gag ggg acc acc aag gcc | 192 |
| Pro Glu Gly Val Glu Gly Ala Leu Leu Ala Glu Gly Thr Thr Lys Ala | |
| 50 55 60 | |
| acc ttc cag tac cgg gcc ctc tcc cgc ctc acg ggg agg ggc ctc ctc | 240 |
| Thr Phe Gln Tyr Arg Ala Leu Ser Arg Leu Thr Gly Arg Gly Leu Leu | |
| 65 70 75 80 | |
| acc gac tgg ggg gaa agc tgg aag gag gcg cgc aag gcc ctc aaa gac | 288 |
| Thr Asp Trp Gly Glu Ser Trp Lys Glu Ala Arg Lys Ala Leu Lys Asp | |
| 85 90 95 | |
| ccc ttc ctg ccg aag aac gtc cgc ggc tac cgg gag gcc atg gag gag | 336 |
| Pro Phe Leu Pro Lys Asn Val Arg Gly Tyr Arg Glu Ala Met Glu Glu | |
| 100 105 110 | |
| gag gcc cgg gcc ttc ttc ggg gag tgg cgg ggg gag gag cgg gac ctg | 384 |
| Glu Ala Arg Ala Phe Phe Gly Glu Trp Arg Gly Glu Glu Arg Asp Leu | |
| 115 120 125 | |
| gac cac gag atg ctc gcc ctc tcc ctg cgc ctc ctc ggg cgg gcc ctc | 432 |
| Asp His Glu Met Leu Ala Leu Ser Leu Arg Leu Leu Gly Arg Ala Leu | |
| 130 135 140 | |
| ttc ggg aag ccc ctc tcc cca agc ctc gcg gag cac gcc ctt aag gcc | 480 |
| Phe Gly Lys Pro Leu Ser Pro Ser Leu Ala Glu His Ala Leu Lys Ala | |
| 145 150 155 160 | |
| ctg gac cgg atc atg gcc cag acc agg agc ccc ctg gcc ctc ctg gac | 528 |
| Leu Asp Arg Ile Met Ala Gln Thr Arg Ser Pro Leu Ala Leu Leu Asp | |
| 165 170 175 | |
| ctg gcc gcc gaa gcc cgc ttc cgg aag gac cgg ggg gcc ctc tac cgc | 576 |
| Leu Ala Ala Glu Ala Arg Phe Arg Lys Asp Arg Gly Ala Leu Tyr Arg | |
| 180 185 190 | |
| gag gcg gaa gcc ctc atc gtc cac ccg ccc ctc tcc cac ctt ccc cga | 624 |
| Glu Ala Glu Ala Leu Ile Val His Pro Pro Leu Ser His Leu Pro Arg | |
| 195 200 205 | |
| gag cgc gcc ctg agc gag gcc gtg acc ctc ctg gtg gcg ggc cac gag | 672 |
| Glu Arg Ala Leu Ser Glu Ala Val Thr Leu Leu Val Ala Gly His Glu | |
| 210 215 220 | |
| acg gtg gcg agc gcc ctc acc tgg tcc ttt ctc ctc ctc tcc cac cgc | 720 |
| Thr Val Ala Ser Ala Leu Thr Trp Ser Phe Leu Leu Leu Ser His Arg | |
| 225 230 235 240 | |
| ccg gac tgg cag aag cgg gtg gcc gag agc gag gag gcg gcc ctc gcc | 768 |
| Pro Asp Trp Gln Lys Arg Val Ala Glu Ser Glu Glu Ala Ala Leu Ala | |
| 245 250 255 | |
| gcc ttc cag gag gcc ctg agg ctc tac ccc ccc gcc tgg atc ctc acc | 816 |
| Ala Phe Gln Glu Ala Leu Arg Leu Tyr Pro Pro Ala Trp Ile Leu Thr | |
| 260 265 270 | |
| cgg agg ctg gaa agg ccc ctc ctc ctg gga gag gac cgg ctc ccc ccg | 864 |
| Arg Arg Leu Glu Arg Pro Leu Leu Leu Gly Glu Asp Arg Leu Pro Pro | |
| 275 280 285 | |

ggc acc acc ctg gtc ctc tcc ccc tac gtg acc cag agg ctc cac ttc 912
 Gly Thr Thr Leu Val Leu Ser Pro Tyr Val Thr Gln Arg Leu His Phe
 290 295 300

ccc gat ggg gag gcc ttc cgg ccc gag cgc ttc ctg gag gaa agg ggg 960
 Pro Asp Gly Glu Ala Phe Arg Pro Glu Arg Phe Leu Glu Glu Arg Gly
 305 310 315 320

acc cct tcg ggg cgc tac ttc ccc ttt ggc ctg ggg cag agg ctc tgc 1008
 Thr Pro Ser Gly Arg Tyr Phe Pro Phe Gly Leu Gly Gln Arg Leu Cys
 325 330 335

ctg ggg cgg gac ttc gcc ctc ctc gag ggc ccc atc gtc ctc agg gcc 1056
 Leu Gly Arg Asp Phe Ala Leu Leu Glu Gly Pro Ile Val Leu Arg Ala
 340 345 350

ttc ttc cgc cgc ttc cgc cta gac ccc ctc ccc ttc ccc cgg gtc ctc 1104
 Phe Phe Arg Arg Phe Arg Leu Asp Pro Leu Pro Phe Pro Arg Val Leu
 355 360 365

gcc cag gtc acc ctg agg ccc gaa ggc ggg ctt ccc gcg cgg cct agg 1152
 Ala Gln Val Thr Leu Arg Pro Glu Gly Gly Leu Pro Ala Arg Pro Arg
 370 375 380

gag gag gtg cgg gcg cat cac cat cat cat cac tga 1188
 Glu Glu Val Arg Ala His His His His His His
 385 390 395

<210> 6

<211> 395

<212> PRT

<213> Artificial sequence

<223> Description of the artificial sequence: C-terminal
His-tagged

<400> 6

Met Lys Arg Leu Ser Leu Arg Glu Ala Trp Pro Tyr Leu Lys Asp Leu
1 5 10 15

Gln Gln Asp Pro Leu Ala Val Leu Leu Ala Trp Gly Arg Ala His Pro
20 25 30

Arg Leu Phe Leu Pro Leu Pro Arg Phe Pro Leu Ala Leu Ile Phe Asp
35 40 45

Pro Glu Gly Val Glu Gly Ala Leu Leu Ala Glu Gly Thr Thr Lys Ala
50 55 60

Thr Phe Gln Tyr Arg Ala Leu Ser Arg Leu Thr Gly Arg Gly Leu Leu
65 70 75 80

Thr Asp Trp Gly Glu Ser Trp Lys Glu Ala Arg Lys Ala Leu Lys Asp
85 90 95

Pro Phe Leu Pro Lys Asn Val Arg Gly Tyr Arg Glu Ala Met Glu Glu
100 105 110

Glu Ala Arg Ala Phe Phe Gly Glu Trp Arg Gly Glu Glu Arg Asp Leu
115 120 125

Asp His Glu Met Leu Ala Leu Ser Leu Arg Leu Leu Gly Arg Ala Leu

| | | |
|---|---|-------------|
| 130 | 135 | 140 |
| Phe Gly Lys Pro Leu Ser | Pro Ser Leu Ala Glu His Ala Leu Lys Ala | |
| 145 | 150 | 155 160 |
| Leu Asp Arg Ile Met Ala Gln Thr Arg Ser | Pro Leu Ala Leu Leu Asp | |
| | 165 | 170 175 |
| Leu Ala Ala Glu Ala Arg Phe Arg Lys Asp Arg Gly Ala Leu Tyr Arg | | |
| | 180 | 185 190 |
| Glu Ala Glu Ala Leu Ile Val His Pro Pro Leu Ser His Leu Pro Arg | | |
| | 195 | 200 205 |
| Glu Arg Ala Leu Ser Glu Ala Val Thr Leu Leu Val Ala Gly His Glu | | |
| | 210 | 215 220 |
| Thr Val Ala Ser Ala Leu Thr Trp Ser Phe Leu Leu Leu Ser His Arg | | |
| | 225 | 230 235 240 |
| Pro Asp Trp Gln Lys Arg Val Ala Glu Ser Glu Glu Ala Ala Leu Ala | | |
| | 245 | 250 255 |
| Ala Phe Gln Glu Ala Leu Arg Leu Tyr Pro Pro Ala Trp Ile Leu Thr | | |
| | 260 | 265 270 |
| Arg Arg Leu Glu Arg Pro Leu Leu Leu Gly Glu Asp Arg Leu Pro Pro | | |
| | 275 | 280 285 |
| Gly Thr Thr Leu Val Leu Ser Pro Tyr Val Thr Gln Arg Leu His Phe | | |
| | 290 | 295 300 |
| Pro Asp Gly Glu Ala Phe Arg Pro Glu Arg Phe Leu Glu Glu Arg Gly | | |
| | 305 | 310 315 320 |
| Thr Pro Ser Gly Arg Tyr Phe Pro Phe Gly Leu Gly Gln Arg Leu Cys | | |
| | 325 | 330 335 |
| Leu Gly Arg Asp Phe Ala Leu Leu Glu Gly Pro Ile Val Leu Arg Ala | | |
| | 340 | 345 350 |
| Phe Phe Arg Arg Phe Arg Leu Asp Pro Leu Pro Phe Pro Arg Val Leu | | |
| | 355 | 360 365 |
| Ala Gln Val Thr Leu Arg Pro Glu Gly Gly Leu Pro Ala Arg Pro Arg | | |
| | 370 | 375 380 |
| Glu Glu Val Arg Ala His His His His His His | | |
| | 385 | 390 395 |

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 <211> 30
 <212> DNA
 <213> Artificial sequence

<220>
 <223> Description of the artificial sequence: PCR primer

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<210> 8
 <211> 30
 <212> DNA
 <213> Artificial sequence

<220>
 <223> Description of the artificial sequence: PCR primer

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<210> 9
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 <212> DNA
 <213> Artificial sequence

<220>
 <223> Description of the artificial sequence: PCR primer

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<210> 10
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 <212> DNA
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 <212> DNA
 <213> Artificial sequence

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